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COLOR PHOTOGRAPHY

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This invention relates to color photography.

Broadly speaking two ways have long been known for producing images corresponding to the various color sensations of nature, namely:

(1st) By producing the images of different color sensations at different depths of a layer or of superimposed layers of light sensitive emulsions:

(2nd) By producing such color images in minute separate juxtaposed areas of a single light sensitive layer or a plurality of such layers.

The two systems have been variously utilised to produce color photographs, the first in what has been called the subtractive method and the second in what has been called the additive method, of color photography.

This invention provides new materials and means for color production in both systems, the second of which, however, is no longer utilised on the additive principle but is made to produce subtractive multi-color pictures.

Organic compounds have long been known which, acting on silver halide salts exposed to light, yield colored oxidation products alongside with silver images. In some cases the developer alone produces the colored image whilst in other cases it requires an additional compound, referred to herein as a color former. Many of the colored products or dyestuffs produced belong to wellknown groups, characteristics of which are indophenols, indamines, indoanilines, azomethines, oxazines, indothiophenols and others and their ring-system products, their nuclear and side-chain homologues and substitution products, their aliphatic or aromatic groups, and like derivatives.

Attempts have been made to employ such color formers to register distinctive color sensations selectively at various depths in a layer or superimposed layers of light sensitive emulsions; but the incorporation of color formers in layers in the emulsion has been subject to the difficulty that the color formers pass into solution in the developer, and give rise to color formation at least in adjoining layers, if not everywhere in the sensitive emulsion.

Among the objects of the present invention are to provide means whereby the action of color formers can be localised relative to the emulsion so that the colors produced thereby do not diffuse from the original positions of the color former particles; also to provide means whereby the speed of penetration of developers into an emulsion can be controlled, and hence their actions can be limited to definite regions in the emulsions.

The present invention is not concerned with any special chemical composition of the color formers, developers, emulsions or other materials although it may employ some of the improved materials described in the present applicant's United States of America patent application Ser. No. 226,381. Neither is it concerned whether the colors are produced in the parts of layers exposed to light or, after reversal, in the parts of the layer not originally exposed, or again whether there is one layer of emulsion or two or three or whether they are coated all on one side or distributed between the two sides of a support. The desired localisation is obtained in a purely physical way in a manner which can be controlled.

According to the present invention the action of a color former is localised by means of a resin or gum resin, associated with the color former or, when the color former is in the developer, with the emulsion.

In one form of the invention the material is adapted to record different color sensations in different layers. In this case either a color former may be incorporated in a layer and associated with a resin or gum resin therein, or alternatively the resin or gum resin may be arranged between layers of emulsion and serve to act as a resist to the action of the developer on the layer beyond. In the latter case also a color former may be incorporated in at least one layer.

In an alternative form of the invention the material is adapted for producing a colored image composed of numerous minute specks or grains of two or more different colors and includes different particles for each color to be produced, each particle including a color former with a resin or gum resin to localise its action and in addition a color filter. The particles may also include appropriate sensitizers.

Both forms of the invention operate on the subtractive principle, that is to say in the finished picture only those colors which are not desired are removed from the light, as opposed to the additive principle customarily employed in connection with mosaic or screen pictures in which all except the required primary colors are removed from the light and the desired color is obtained by synthesising such primary colors emanating from neighbouring areas of the picture.

A further feature of the invention is the employment of particles as described for the production of one or more colors and the employ-

ment of the interstices between such particles for the production of a further color.

The invention includes the improved photographic sensitive material and also the process of preparing it. The latter preferably includes forming a solution of a resin and a color former in a common solvent and applying the resulting mixture of resin and color former to a sensitive emulsion either by mixing it with the emulsion before coating on a support or by applying it to the surface of the emulsion after the latter has been coated on to its support.

The invention also includes the process of developing the improved materials. This may in some cases be performed by employing developers appropriate to the color formers in the ordinary way. Alternatively for a photographic material containing resins of progressively decreasing solubility in alkali in or between successive layers of emulsion intended to record different colors, successive layers may be developed with developers appropriate to the colors of the layers and of progressively increasing alkalinity. Thus the resin will act as a resist to the action of the developer whilst the first layer is developed, but the subsequent employment of a developer of increased alkalinity will dissolve the layer of resin and allow the developer access to the next layer of emulsion.

Similarly for a photographic material incorporating a plurality of different color formers associated with different resins of progressively decreasing solubility in alkali, developers of progressively increasing alkalinity may be employed appropriate to the several color formers. Thus there will first be employed a developer of minimum alkalinity appropriate to the color former associated with the resin which is most readily soluble, followed by developers of increasing alkalinity appropriate to the color formers associated with resins of decreasing solubility.

A further feature of the invention is the employment of what may be referred to as a color and black method of development for a photographic material intended to record one color sensation in a surface layer and another in a deeper layer. This includes first developing with a mixture of a black developer and a color developer containing but little alkali sulphite to form a black surface image and a deeper colored image, bleaching the black image and redeveloping in another color. Further details and explanation of this method will be given hereafter.

Certain specific examples will now be described.

In the first example to be described the sensitive material is adapted to record different color sensations in different layers and has different color formers in the different layers each associated with a resin or gum resin to localise its action.

This may be effected by dissolving the color formers in a non-aqueous solvent together with a natural or synthetic resin or gum resin, such as colophony or gum mastic, or the like, then mixing such solution, little by little while stirring, with a light sensitive emulsion of with an aqueous solution of a colloid, such as gelatine, for addition to an emulsion.

The result is that resin and color former are suspended in the emulsion in fine dispersion of particles in each of which is present both resin and color former, physically attracted to each other by their common water-repellent property. It is a wellknown fact that resins have marked

adhesive properties, which also contribute to the localisation of the reaction. There is a wide range of resins, both natural and synthetic, for any volatile solvent and of various solubility in alkali, from those which require a very small quantity of a carbonate to those that require greater alkalinity up to that of caustic hydroxide, so that any can be chosen which will resist the action of a developer of given alkaline content for the desired time.

Besides the resins mentioned, namely colophony and gum mastic, other natural resins and gum resins available include shellac, sandarach, dragon's blood, dammar, and others, while synthetic resins may be the condensation products of formaldehyde or phenol alcohols with phenols, oxy-, aryloxy-, or alkyloxy-carboxylic acids or phenoxy fatty acids; also such synthetic resins which may further be treated with halogen fatty acids or the condensation products of phenols or phenol-carboxylic acids with aliphatic, aromatic, or heterocyclic aldehydes or thionylchloride.

When a solution of a suitable resin or gum resin is mixed with a solution of a color former and dispersed in an emulsion, it acts, in a way, as a resist to the action of developer preventing the color former from migrating to other layers, while it does not prevent color development, which, however, is strictly localised to the silver halide adjacent to each particle. For instance, if an emulsion is made to contain particles as described and, for demonstration purposes, these are very widely scattered, and is then developed in the appropriate color developer, only the parts where the particles are present are developed in color, yielding an image formed of little dots, the interstices between particles remaining colorless. If, on the other hand, a black developer is instead applied, it acts only in the interstices between particles; and subsequently, if desired, a color developer can be applied, which will only act in the parts where particles are present.

It is clear that the quantity of particles can be such as to give such a close formation as will leave no interstices between particles, one being always present over or under interstices to close up any gap.

As an example, a 5% solution of colophony in acetone or gum mastic in alcohol and acetone is made, and of this 5 to 10 c. c. are taken, and gm. 0.50 of a color former, such as alpha naphthol, or gm. 0.25 of such agent as p-nitro benzyl cyanide is dissolved in it.

The solution is then mixed either directly in 100 c. c. of a diluted silver halide emulsion or in 40 c. c. of a 7 or 8% gelatine solution, which is afterwards added to 60 c. c. of silver halide emulsion. The color yield by the color formers in such conditions is so abundant that the emulsion can well stand dilution as mentioned, but may be used in greater density if desired.

It is easily understood that one, two or three layers of emulsions can be coated on one side or distributed between the two sides of a support, each layer containing a localised color former for one of the two or three main color sensations, so as to produce colored pictures according to accepted principles of subtractive color photography. Separation layers are not strictly necessary, unless they may be required for color filtering purposes. The layers may be suitably and differently color sensitised, or, if the material is to be utilised for positive making in accordance with the co-pending patent application referred

to above, at least one of them need not be color sensitised.

If it is desired to develop one color at a time or one separately from the others, then color formers may be chosen which require different developers; or else two or more resins or gum resins, natural or synthetic, are chosen, which are soluble in different quantities or strengths of alkalis; and development in successive operations is effected with different developers or with solutions of different alkali content, as required by the resins employed.

The resins may either be incorporated in the layers of emulsion or alternatively they may be in separating layers which may also contain light filters or sensitizers. In either case the layers contain either progressively decreasing quantities of resin from the support to the outer surface of the emulsion, or else different resins of increasing solubility in alkali. The first developer for one color may contain a very weak alkali and in a specified time will only act on the first resin layer. For the next layer a developer for a different color and more strongly alkaline is needed in order to dissolve away the first resin layer and act on the second layer. Any subsequent developers will, of course, have increasing alkali contents, each sufficient to act on one further resin layer. In this manner successive layers can be developed in different colors, the color formers being incorporated either in the appropriate developers or resin layers.

It is found that when a layer contains alpha naphthol, whether localised or not, a second layer of emulsion applied over tends not to adhere permanently to it. This is obviated by incorporating in the second layer a minimum quantity again of alpha naphthol, quite negligible as far as color yield is concerned, but quite efficient to make the layer adhere on the first: for instance gm. 0.08 of the chemical dissolved in a little alcohol and mixed with 100 c. c. of emulsion, is sufficient.

When a layer contains alpha naphthol or other color former which gives one color with one developer and another with another developer, any such color may be developed depending on the kind of color rendering desired, for instance whether in direct or in complementary color or whether reversal is applied or otherwise. In the case of alpha naphthol, it can give blue with diethyl-p-phenylene diamine or red with 2-amino-5-hydroxytoluene or with p-amino-phenol.

It is quite obvious that when successive color treatments are applied fixing may be left as the last operation.

It is also found that in many cases when selective development is desired, an amidol developer, or the old ferrous oxalate developer which requires no alkali nor sulphite, are quite effective for the production of a black stratum.

In a general way resins retard the penetration of developers, thus prolonging time of treatment, but this, far from being a drawback, is desirable for control of effects and for selective treatments. They also have the advantage of rendering the materials better able to withstand alkali or acid treatments such as acid fixing and reversal processes.

In some instances it may be desirable to incorporate localised color formers only in one or two of the lower layers and apply color and black development as briefly referred to above so that at least the top color may be produced in a sec-

ond operation, such procedure allowing control of the top color, which is desirable, especially when this top color is to be the blue record. This color and black development constituting one feature of the present invention allows a colored stratum to be produced at a depth that can be adjusted almost at will so that it can be made to coincide with the divisions between layers of emulsion, if any, or be limited approximately to the depth penetrated by rays of one color, preferably also permitting the formation of at least two stratifications in one single treatment or operation.

The underlying principle of the color and black method is as follows. When color formers are employed to develop a photographic surface in color, there is necessarily produced alongside with the dye image a certain amount of black reduced silver. This amount of silver is dependent inter alia on the quantity of alkali sulphite present in the developing solution. The function of the sulphite in ordinary developers, referred to herein as "black" developers, is well known; being avid of oxygen, the sulphite combines with it as it is evolved on decomposition of the silver halide, and thus prevents the developer itself from being oxidised and hence rendered inactive in a very short time. In color development the sulphite is no longer necessary, moreover it is a handicap as it would prevent the oxidation of the developer, which in this case is desired to produce a dyestuff. Hence very little sulphite is used in color development, generally from two grammes to four grammes per 1000 c. c. of solution, or as little as necessary to impart contrast to the dye image.

Color developers are very slow in their action as compared to black developers and in any case there is a wide range of black developers for one to be chosen that is very rapid in comparison to any color developer that it may be necessary to use. Thus if a small quantity of a rapid black developer is combined in suitable proportions with a larger quantity of a slower color developer, in the presence of a small quantity of sulphite, the black developer acts quickly almost alone on the first strata of a photographic material under treatment but is quickly oxidised and rendered inert while the color developer continues in its action on the lower strata: thus there is obtained in the upper parts of the material a practically pure silver image and in the lower parts a practically pure dye image. The silver image can then be bleached and on a second development in another color, the latter is produced in place of the first developed image. The second development can also be again one combined of black developer and color developer as in the first instance, in which case three color strata will ultimately be obtained.

The relative quantities and speeds of black developer and color developer and the quantity of sulphite can be so adjusted that the stratification of black and of color can be obtained, in a given time, for an emulsion or emulsions of given resolving power, practically at any desired depth.

As an example, the following solutions are prepared:

- (a) Sodium carbonate, anhydrous, gm. 40, potassium bromide gm. 2, water c. c. 960.
- (b) Metol gm. 0.75, sodium sulphite anhydrous gm. 11, hydroquinone gm. 1.50, water c. c. 250.

(c) Diethyl-p-phenylene diamine hydrochloride gm. 2, sodium sulphite anhydrous gm. 4, water c. c. 100.

(d), p-Nitro benzyl cyanide gm. 0.50, acetone c. c. 10, methyl alcohol c. c. 30, water c. c. 10.

For use, take (a) 40 c. c., (b) 5 c. c., (c) 5 c. c., (d) 2 to 3 c. c.

This will give equal depth stratifications of black and red on a two layer material, but, of course, the proportions vary in accordance with the characteristics of the emulsions. The various solutions can be compounded differently, and reduced to two stock ones to the same effect.

In similar manner stratifications of two colors or of two colors and black can be obtained, in the case of two colors by choosing two developers and color formers which are of different rapidity and of which one is compatible with the presence of larger quantity of sulphite than the other.

Glycin is a very good black developer for use in treatments in this manner, and so also p-amido phenol as a black developer. In some cases the solution may contain potassium bromide as it is well known that some black developers resent its presence strongly and some very little, and the same has been found to be true of color formers. It is impossible to give rigid rules and formulae due to the number of different color formers available quite apart from variations in the degree of purity of individual compounds. The precise quantities can be ascertained by trial for any given color former and quality of emulsion.

Addition of small quantities of a fixing agent, such as sodium thiosulphate, to the compounded solution, contributes to the formation of pure black stratifications, while addition of potassium ferrocyanide helps the formation of pure color in the relative stratum.

The invention may also be employed in conjunction with photographic materials which contain color formers incorporated in fine dispersion in or between emulsions. For instance, if a color former is present in a lower stratum of emulsion or in two lower strata of emulsions and another or other upper layers are not provided with such agents, then the treatment previously described acts even better, the color former being, of course, omitted from the compounded solution.

If two color formers are distributed in two different layers of emulsions they may be chosen of different propensity to oxidation, so as to give rise automatically to the characteristic results of my treatment. Black developer can still be incorporated in the compound solution, for production of silver image in a third top layer. Or again, with one color former in the lowest only of three layers, a compound solution can be made of a black developer, the color developer required by the color former present in the material, and another color former of faster action with its own color developer if necessary, when in one operation two colored layers and one of black silver are obtained.

Finally, it is obvious that a color that is produced in second operation in place of black silver firstly developed, can be obtained by other means than color development, for instance by toning, dye toning, dye destruction and so forth.

In another form of the invention the material is adapted for producing a color image composed of numerous minute specks of two or more different colors and includes different particles for

different colors to be produced. A feature of the invention is the production of a further color in the interstices between the particles.

In this application of the invention the well-known principles of mosaic and screen filter formations are employed in conjunction with the localisation method referred to above to produce multi-colored pictures not by the additive but by the subtractive system.

Each particle comprises a resin or gum resin, a color former, a coloring matter to act as a filter, and if necessary a color sensitiser. These are dissolved in a volatile solvent such as alcohol, acetone, xylene, or mixtures of these substances.

The solution may then be added to a solution of gelatine or any other suitable medium for addition to an emulsion, or else direct to an emulsion. The particles remain suspended in the emulsion and may act as color filters to the material beneath them. On development the exposed particles produce colored areas, the whole forming a multi-color image. The colors of the original particles must always be removed, either by decoloration or solution in the developer, or by a subsequent treatment.

The colored particles may contain color formers which either produce a dyestuff of the same color as the filter, or of its complementary color.

The area or mosaic effect does not ultimately appear, owing to a slight color diffusion round each particle.

Such color particles may be utilised in a photographic material in various ways of which the following are examples.

Whenever henceforth reference is made to "one particle" the expression is intended to mean a number of localised particles of one color with the appropriate color former, and similarly "two particles" and "three particles" are intended to mean particles for producing two colors and for producing three colors respectively.

1. A single panchromatic emulsion contains in fine dispersion two or three colored particles intermixed in due proportions. If there happens to be any small gap between particles or if there is any silver halide not provided with any of such particles or over any of them, no harm is done because in those parts only black is produced which is finally removed. Color development is applied with the requisite developer or developers in a single operation, or, if desired, when the color formers call for more than one developer, in simultaneous or successive operations, with final removal of all color filters, silver, and silver halide. If desired, each particle may be made to contain also the required sensitiser.

2. Only two colored particles (of localised and colored color formers) are dispersed in an emulsion, which may contain a general filter to serve for the third color: the emulsion may be panchromatic or only sensitive to the one color the agent for which or for the complementary of which is not provided in particle form. In the latter case the two particles carry their appropriate sensitisers. The third color is developed in the interstices between the two particles, either by applying color-and-black development as previously described, or by adding the third color former, and if necessary its color developer, to the developing solution. If desired, successive treatments can be applied instead, first developing the interstices in black, and then developing the colors. Ultimately all color filters, silver halide and silver are always removed.

3. Two emulsions are utilised, one plain or

containing colored or colorless particles for one color, and the other containing one or two particles for another or other colors. Simultaneous development of all colors or separate developments can be applied, as in previous cases, with the same final removal. The interstices between particles of both emulsions can be made to produce another color.

4. Three localised colored particles, with or without sensitizers, are mixed in a weak solution of a colloid or other binding agent and coated in a thin layer over a silver halide emulsion. Treatment is in one operation or in successive operations as desired, always with final removal as mentioned.

5. Three particles as in the preceding case can be formed over one emulsion, without binding agent or medium other than the resin or gum resin that is utilised. Various methods can be followed: for instance each of the three color formers is dissolved in a solvent and with a resin or gum resin and with a coloring matter different from the other, choosing such resins and coloring matters as will not dissolve in the solvent of the other: the three solutions may be mixed and applied or sprayed over the photographic surface in one operation or may be individually applied in successive operations: as the solvents, at least, are different, a second application will not interfere with the previous one. On volatilisation of the solvents, three particles are left adhering to the surface. The treatments are as before, with the difference that the particles can ultimately all be quickly eliminated by application of a mixture of these solvents or of a solvent common to all. The particles may be only two, the third color being produced in the interstices.

6. Two or three particles are emulsified in plain water, with addition, if desired, of a little glycerine, plastifier or the like, and are applied, coated or sprayed over the photographic material.

7. Two or three localised particles as in previous cases are suspended in aluminium hydroxide jelly freshly prepared and are coated over an emulsion. The same treatments are used. The overlayer can be removed in due time with a solvent for the alumina jelly.

8. Two or three particles again as before are suspended in an easily soluble medium other than a colloid: for instance in cellulose acetate dissolved in benzole: such a medium is easily dissolved finally in alcohol or in a mild acid such as lactic. Again, the treatments are the same.

9. Two or three particles as before are produced, dried, finely powdered and applied or blown, on to a photographic surface just moistened or thinly overcoated with an adhesive or colloid layer still wet. Again the treatments are the same.

10. When two localised particles only are coated, produced, or applied over an emulsion, as in previous cases, the third color can be developed in the interstices, as has been specially mentioned in certain cases.

11. One emulsion contains particles for one color, and two other particles for two other colors are coated, produced, or applied over the emulsion, the first color contained in it being developed through the interstices between the overlaid particles. The treatments are as in other cases.

12. This example is similar to the preceding one, with the difference that particles for one color only are overlaid: the third color being

developed in the interstices between the overlaid particles. Very close color formation is thus obtained, the treatments being as already described.

13. Two emulsions are utilised, one containing particles for one color and particles for two other colors or for another color being applied, produced, or coated over the whole. Treatments are similar to those used in similar cases.

14. One or more particles can be formed of color former and coloring matter alone, without resin, finely powdered and then suspended in a resin solution, more especially of an artificial resin, which is afterwards applied in a thin layer over the emulsion as a lacquer or varnish. Other varnishes, for instance, of benzyl cellulose, or any other suitable type, may be used.

15. Forms other than mosaic may be adopted in any of the examples given: for instance, screen or pattern, or lines in one direction or crossways: such formations can be produced mechanically by means of rollers and in any other suitable way. These applications are obvious and need not be specially described.

16. One particular method of forming a two color screen of particles in an easy way consists of first applying very thinly on a photographic surface a mixture of water and alcohol or water and other volatile solvent: the surface then is made to pass under a mild blow of hot air which volatilises such solvent leaving minute globules of water: instead of this procedure, water vapour uniformly applied can serve the purpose. In the case of mixtures of water and a volatile solvent, the proportions of the two determine the size of the ultimate grain: one part of water and two of volatile solvent answer most purposes. Immediately afterwards there is applied thinly over the surface a solution of resin with color former and dye for color filter all in a volatile solvent. This will dry quickly in very minute particles, and soon afterwards again a water solution of another water-soluble color former, with another sensitizer if necessary and with other coloring matter for filter, always water-soluble, is applied, which will only remain in the interstices between the particles first formed. Production of a third color may be caused in the inside of the emulsion.

Many other formations are possible, as those skilled in the art will readily understand, and two or more kinds of natural and synthetic resins and gum resins and solvents or other resists can be made use of, for selective treatments as described.

These mosaic or part-mosaic like materials are best utilised for making multi-color positives, more especially on paper supports.

When one or two particles as described are suspended in an emulsion or better still are produced or coated over the same so as to leave small clear interstices or line spaces in between them, if a sensitizer is then applied in a solution which also contains water, it acts almost solely in the interstices or line spaces, and thus selective part area sensitisation can be achieved: or else, or at the same time, another color former in solution containing water can be applied, thus attaining also a very close formation of color formers.

It is further found that particles as described for one or more colors can be emulsified in a water solution of tragacanth gum, say 0.50 or 1 per cent, and coated over an emulsion. Such a layer will remain firmly in place for so long as may be required and after treatment is is easily

removed physically by very slight rubbing while wet or with a squeegee.

Layers or formations of one or more particles as described can be made also between or under light sensitive layers; when between, they also serve as separation layers; and, if carried by a medium, the latter may be made to contain a supplementary color filter.

In a variation, particles in mosaic form or lines, of one or more colors, are made to contain only the color filter and resin as resist, without color former; and then successive developments in color or black can be applied; for instance first in black with little or no alkali, which will act in the interstices or line spaces, then with a color developer with such alkali or solvent as will attack one of the resins only, and so forth. Or, in the case of particles or lines of one color only with spaces between, first black or one color may be developed in the spaces, then the particles or lines of resist are removed in a solvent, and another color development is applied which can only act in the areas uncovered: color former for a third color may be contained, localised or otherwise, in the emulsion or in a lower emulsion, and be contemporarily developed both or either in first and second treatment.

Materials in which an emulsion is overcoated with lines or dots of one color and spaces or other lines in another color may be utilised to impress thereon a pair of stereoscopic pictures, one of the pair being filtered in a color and the other in another color so that the lines of one color reproduce, say the left view and the others the right view, when stereoscopy alone or stereoscopy in colors may be obtained in suitable viewing or projecting arrangements.

Finally, specially when particles are to be applied without a binder or medium over one emulsion, it may be expedient to form or lay the particles first on a temporary support, when, in full lighting circumstances and without danger of damaging an emulsion, they may be arranged to perfection, and then transfer the formation on to the photographic material by bringing them into contact, the photographic material being previously moistened or coated with a thin colloid or adhesive layer.

What I claim as my invention and desire to secure by Letters Patent is:

1. A photographic gelatino silver halide sensitive material having different color formers incorporated in differently color-sensitive regions thereof, characterised in that each color former is associated with, but not chemically combined with, a resin to localise its action.

2. A process of preparing a photographic sensitive material which includes forming a solution, but not a chemical combination, of a resin and a color former in a common solvent and mixing the resulting mixture of resin and color former with a sensitive emulsion.

3. A photographic gelatino silver halide sensitive material having different light-sensitive layers incorporating different color formers adapted to record different color sensations, at least one color former being associated with, but not chemically combined with, a resin to localise its action.

4. A photographic sensitive material adapted for producing a colored image composed of numerous minute grains of at least two different colors, including different particles for different colors to be produced in contact with a light-

sensitive emulsion, each particle including a color former, a color filter and a resin to localise the action of the color former.

5. A photographic sensitive material according to claim 4, in which the particles of at least one color include also an appropriate sensitiser.

6. A photographic sensitive material according to claim 4, in which particles of at least one color are incorporated in the body of an emulsion.

7. A photographic sensitive material according to claim 4, in which particles of at least one color are applied to the surface of an emulsion.

8. A photographic sensitive material according to claim 4, in which at least two layers of emulsion containing said particles are employed.

9. A process of making a sensitive photographic material for producing a colored image composed of numerous minute grains of at least two different colors, which includes incorporating in contact with a light sensitive emulsion different particles for the several colors to be produced, each particle including a color former, a color filter and a resin to localise the action of the color former.

10. A process of producing a photographic sensitive material, which includes dissolving a resin and at least one color former capable of forming a dye selected from the group consisting of indophenols indamines, indoanilines, azomethines, oxazines and indothiophenols in a non-aqueous solvent and mixing them with a light sensitive emulsion.

11. A process of producing a photographic sensitive material, which includes dissolving a resin and at least one color former in a non-aqueous solvent, adding them to an aqueous solution of a colloidal material, and adding the latter to a light sensitive emulsion.

12. A process of producing a photographic sensitive material, which includes dissolving a natural resin and at least one color former in a non-aqueous solvent, adding them to an aqueous solution of a colloidal material and adding the latter to a light-sensitive emulsion.

13. A process of producing a photographic sensitive material, which includes dissolving a natural resin and at least one color former in a non-aqueous solvent, adding them to an aqueous solution of gelatin and adding the latter to a light-sensitive emulsion.

14. A process of producing a photographic sensitive material, which includes mixing with a light sensitive emulsion a plurality of solutions each including a color former, an appropriate color filter and a resin.

15. A process of producing a photographic sensitive material, which includes adding to an aqueous solution of a colloidal material a plurality of solutions each including a color former, an appropriate color filter and a resin, and mixing the colloid solution with a light sensitive emulsion.

16. A process of producing a photographic sensitive material, which includes coating on the surface of a light-sensitive photographic material a plurality of solutions each of which includes a resin, a color former and an appropriate color filter.

17. A process of producing a photographic sensitive material, which includes coating on the surface of a light-sensitive photographic material a water emulsion of a plurality of different color particles each including a resin, a color former and an appropriate color filter.

18. A process of producing a photographic

sensitive material, which includes coating over the surface of the light-sensitive photographic material a suspension in aluminium hydroxide jelly of a plurality of different color particles each including a resin, a color former and an appropriate color filter.

19. A process of producing a photographic sensitive material, which includes coating over the surface of a light-sensitive photographic material a suspension in a solution of a cellulose ester of a plurality of different color particles each including a resin, a color former and an appropriate color filter.

20. A process of producing a photographic sensitive material, which includes forming a plurality of powders each consisting of particles including a color former, an appropriate color filter and a resin and applying such dry powders

to the surface of a light-sensitive photographic material which has been treated so as to cause them to adhere to it.

21. A process of producing a photographic sensitive material, which includes forming a plurality of powders each consisting of particles including a color former and an appropriate color filter, suspending such powders in a resin solution and applying the latter as a varnish to the surface of a light-sensitive photographic material.

22. A photographic process for treating the material claimed in claim 8, which includes exposing and color-developing it, and decolorising the color former of the particles subsequent to exposure.

MICHELE MARTINEZ.

CERTIFICATE OF CORRECTION.

Patent No. 2,269,158.

January 6, 1942.

MICHELE MARTINEZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, second column, line 13, claim 22, for the claim reference numeral "8" read --4--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of March, A. D. 1942.

(Seal)

Henry van Arsdale,
Acting Commissioner of Patents.